

Effect of the Energy Drink “Red Bull” on the Amateur Football Players’ Aerobic and Anaerobic Performances

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Abstract

This study was conducted to investigate effect of 250 ml of Red Bull energy drink consumed 60 minutes before an intensive exercise on aerobic and anaerobic performances of amateur football players (subjects were PE students).

In this study, a crossover research design was applied. Test subjects were divided into two groups, namely A and B. In the first experiment, group A was provided Red Bull, and group B was given apple juice (placebo) and tests were carried out. In the second experiment, the same tests were carried out by interchanging the drinks provided to the groups previously. The aerobic performance assesment was performed with the Yo-Yo Intermittent Recovery Test (Level 1) while the anaerobic performance assesment was carried out with the Wingate test. The differences between the groups were analyzed by Wilcoxon Signed-Ranks Test, and the significance level was accepted as $p < 0.05$.

As a result of the tests applied to Red Bull and Placebo groups; there was seen no significance difference between the maximal VO_2 values of the groups (Red Bull, $\bar{x} = 49.50 \pm 3.14$ ml/kg/min; Placebo, $\bar{x} = 48.81 \pm 3.07$ ml/kg/min, $z = -1.244$, $p > 0.214$). Additionally, according to the Wingate test results, no significant difference was found between the Red Bull and Placebo groups. (Peak Power: Red Bull $\bar{x} = 877.56 \pm 164.82$ W, Placebo $\bar{x} = 841.67 \pm 162.23$ W ($z = -1.48$, $p > 0.13$), Average Power: Red Bull $\bar{x} = 616.70 \pm 99.17$ W, Placebo $\bar{x} = 603.69 \pm 92.05$ W ($z = -1.59$, $p > 0.11$), Time at Peak Power: Red Bull $\bar{x} = 2.21 \pm 0.95$ sec, Placebo $\bar{x} = 1.97 \pm 1.00$ sec ($z = -0.29$, $p > 0.76$).

As a result, it was observed that the performances of amateur footballers did not show a significant increase when Red Bull energy drink was consumed one hour before Yo-Yo Intermittent Recovery Test (Level 1) and Wingate Anaerobic Power Test. Considering unconscious consumption of caffeinated drinks and its possible side effects, it is not recommended for athletes who are not used to it.

Keywords: red bull, Wingate anaerobic power test and Yo-Yo intermittent endurance test (Level 1)

1. Introduction

Energy drinks are widely consumed by college-age individuals (Elitok et al., 2015) and by athletes (Peveler et al., 2017). Red Bull is among the most popular energy drinks with its annual global sale of several billion dollars (Ragsdale et al., 2010). Consumption of energy drinks may lead to an increase in attention, cognitive functioning, and metabolic activities (Guley et al., 2015). Froiland et al. (2004) found out that 73% of college athletes consumed energy drinks to improve their performances. Moreover, Hoyte et al. (2013) presented that more than 80% of college students who were also athletes continue to consume energy drinks to potentially increase their performance. The consumption rate of energy drinks among the college students in our country is approximately 78% (Bulut et al., 2014). For this reason, recently several studies have been conducted on college students to analyze the effect of energy drink consumption through different performance types (Garcia ve ark., 2017; Aljaloud, 2016; Goel et al., 2016; Reid et al., 2015).

Today, energy drinks are used frequently among athletes. They believe that these drinks enable them to become mentally relaxed, and their physical strength is improved with the help of these drinks (An et al., 2014). Caffeine is known as the main ergogenic agent in energy drinks (Scott et al., 2007). However, the amount of caffeine in energy drinks varies (Jamer, 2013). When caffeine is absorbed by the body, it stimulates the sympathetic nervous system causing an increase in plasma catecholamine levels, which puts the body under stress. For example, when caffeine is consumed the release of epinephrine and norepinephrine in the heart increases, and this leads to an increase in heart rate and blood pressure (Lee,

2000). Consumption of a can of Red Bull_ by college-aged students was not associated with cardiovascular abnormalities. In this respect, consumption of a single can (250 mL) of Red Bull appears to be safe (Ragsdale et al., 2010). It has also been scientifically proven that consuming caffeine at medium dose (3-6 mg/kg) one hour before exercise increases aerobic and anaerobic performance in team sports such as football (Eckerson et al., 2013).

Based on the information provided above, in this study, with the help of Wingate Anaerobic Power Test and Yo-Yo Intermittent Endurance Test (Level 1), the effect of consuming 250 ml of Red Bull on the performances of 18 amateur footballers aged between 18 and 25 was examined.

2. Method

2.1 Participants

In the study, a total of 18 male Physical Education and Sports Department students who had been training for 2 months and had 3 years of active amateur footballer license participated voluntarily. These participants' mean age was 21.00 ± 1.58 years and their mean height was 175.11 ± 6.75 cm and their mean weight was calculated as 70.57 ± 9.10 kg.

In this study, aerobic and anaerobic performances of amateur footballers were measured in two different experiments by applying crossover design. The volunteers were divided into two groups as A and B. The participants were told to have breakfast as usual, not to use caffeine-containing products and to have their last meal 3 hours before the tests. Under the supervision of the researchers, the participants were provided with Red Bull and apple juice consumed 60 minutes before the tests. An apple juice was chosen as a placebo because of its color and taste. Besides sugar percentages of the apple juice and the Red Bull drink were equalized by diluting the apple juice with water. Participants were not given any information about the product they consumed before the test, and the products were served in transparent plastic cups. In the first experiment, while 250 ml of Red Bull energy drink was given to group A, 250 ml of apple juice was given to participants in group B, and experiment were taken. In the second experiment, 250 ml of Red Bull energy drink was given to group B while 250 ml of apple juice was provided to the group A. There was given a 48 hours of break between the tests. The height and weight of each participating athlete were recorded before Wingate and Yo-Yo Intermittent Recovery Test (Level 1). The athletes were in the laboratory 1 hour before the measurements. The measurements were carried out between 17:00 and 19:00 at Abant İzzet Baysal University School of Physical Education and Sports Exercise Laboratory and Hall C. The participants were notified 24 hours prior to the test that they should not do any intensive exercise, and not to have tea, coffee, coke, chocolate, and food or beverages that contained caffeine after 22:00 with a text message. It was also ensured that they wore the same clothes and shoes during the tests.

All the athletes were informed about the study beforehand and voluntary participation forms were signed by each participant. This study was approved by the Ethics Committee of Bilecik Şeyh Edebali University (2018/8498).

2.2 Measurements

The weights of the participants were measured with SECA weighing scale with graduation increments of 0.05 kg, and the results were recorded in kilograms. Additionally, the heights of the participants were measured with SECA scale with graduation increments of 0.01 m.

The Yo-Yo Intermittent Recovery Test (Level 1) which was particularly developed for the sports football was performed by the volunteers in the hall and on a parquet floor. In Yo-Yo tests, participants perform 2X20 meter shuttle runs back and forth between start, turn-around, and finish lines at gradually increasing speeds. Between each shuttle run there is a 5-meter track where the volunteers walk or jog for 10 seconds as an active recovery period. The speed of the volunteer during the test is determined with the help of beep signals that are automatically controlled by a CD player. 2-meter-wide and 20-meter-long track setup is designated by using cones. Two other cones are placed 5 meters behind the start and finish lines, and this area is the active recovery area. When the athlete runs out of strength to continue or he fails to reach the finish line twice, the test finishes, and the total distance (including the running distance in the unfinished lap) ran is calculated as the test result (Figure 1).

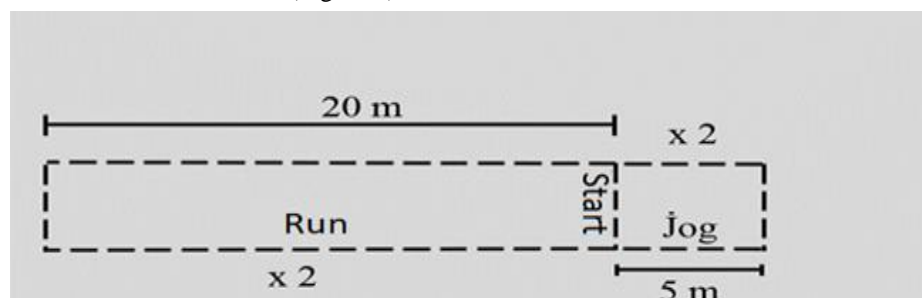


Figure 1. The Yo-Yo Intermittent Recovery Test (Level 1) Setup.

VO₂ max: The distance run (m) x 0.0084 + 36.4 (Bangsbo, 2008).

Wingate anaerobic power test is a test to measure lactic and alactic anaerobic capacity. The test lasts 30 seconds. Before the test, each volunteer did warm-up exercises by pedalling a cycle ergometer until their heart rate reached to 140-150 beats/min. A weight of 7.5% of volunteer's the body mass was loaded on the strain gauge in the cycling ergometer. The test was started when this weight was removed. At the end of the test, the maximal power in the first 5 seconds of the test and the total performance at the end of 30 second-test were calculated. All scores was calculated automatically and taken from the software related with the Wingate test on computer.

2.3 Analysis of Data

Data were transferred into a computer environment and analyzed by using SPSS. After the descriptive statistics of the participants were calculated, to see whether the data were distributed normally, Shapiro-wilk test was performed, and it was observed that the data were not normally distributed. Differences between the groups were investigated with Wilcoxon Marked Rank test and significance value was accepted as $p < 0.05$.

3. Results

Table 1. Some physical characteristics of footballers (n: 18) participating in this study

	$\bar{x} \pm sd$
Age (year)	21.00 \pm 1.58
Height (cm)	176.11 \pm 6.75
Weight (kg)	70.57 \pm 9.10

\bar{x} : mean;

sd: standard deviation

Table 2. Comparison of max VO₂ by looking at the results from yo-yo intermittent recovery Test (Level 1) of placebo and red bull groups

Variable	Group	$\bar{x} \pm sd$	z	p
Max VO ₂ (ml/kg/min)	Placebo Group	48.81 \pm 3.07	-1.24	0.21
	Red Bull Group	49.50 \pm 3.14		

$p > 0.05$

When the results from the Yo-Yo Intermittent Recovery Test (Level 1) were examined (Table 2), it can be seen that the Max.VO₂ value of the group receiving Red Bull drink was higher. However, this difference was not statistically significant ($p > 0.05$ $z = -1.24$).

Table 3. Comparison of the values of Wingate peak power (watts), average power (watts), time at peak power (sec), decline in power (watts), in placebo and red bull groups

Variables	Group	$\bar{x} \pm sd$	z	p
Peak Power (W)	Placebo Group	841.67 \pm 162.23	-1.48	0.13
	Red Bull Group	877.56 \pm 164.82		
Average Power (W)	Placebo Group	603.69 \pm 92.05	-1.59	0.11
	Red Bull Group	616.70 \pm 99.17		
Time At Peak Power (sec)	Placebo Group	1.97 \pm 1.00	-0.29	0.76
	Red Bull Group	2.21 \pm 0.95		
Decline in Power (W)	Placebo Group	477.06 \pm 121.51	-0.29	0.76
	Red Bull Group	471.54 \pm 121.79		

* $P < 0.05$

According to Table 3, when results from Wingate Anaerobic Power Test were examined, the values of Decline in Power ($z = -0.29$, $p > 0.76$), Peak Power ($z = -1.48$, $p > 0.13$), Average Power ($z = -1.59$, $p > 0.11$) Time at Peak Power ($z = -0.29$, $p > 0.76$) of the group consuming energy drink Red Bull were observed to be higher in sportive performance. However, these differences were not statistically significant.

4. Discussion

The purpose of this study was to investigate the effect of Red Bull energy drink on the aerobic and anaerobic performances of footballers. To achieve this, the aerobic performance was measured with the Yo-Yo Intermittent Recovery Test (Level 1) while the anaerobic performance was measured with the Wingate Anaerobic Power Test. When we examine the first finding of our study (Table 2), the results from the Yo-Yo Intermittency Test (Level 1) showed that there was no significant difference in maximum VO₂ values between the Placebo and Red Bull groups ($p > 0.05$). An et al. (2014) in their study with 15 male college students stated that the group consuming energy drink (2.5 mg/kg caffeine) became exhausted much later than the control group received water (0 mg/kg caffeine). Moreover, in a study by Janae et

al. (2011), volunteers were given three types of energy drinks and were asked to consume their drinks 30 minutes before their run. There was no significant difference between the maximum VO_2 values of the participants. This case was explained by low dose of energy intake and low exercise intensity (50% Max VO_2). In another study, 17 male college students were given sugar-free Red Bull 60 minutes before the exercise which required participants to run at 80% of Max VO_2 , and it was reported that the Red Bull intake did not affect the time of exhaustion (Candow et al., 2009).

As can be seen in Table 3 when we examine the second finding of our study, Wingate Anaerobic Power test results indicated that there were no significant differences between the groups ($p > 0.05$). In their study of 90 semi-professional footballers, Coso et al. (2012) gave sugar-free Red Bull (3 mg/kg caffeine) to exercise group and gave sugar-free Pepsi (0 mg/kg caffeine) to their control group. As a result, they stated that consuming Red Bull containing caffeine 60 minutes before exercise leads to an increase in the number of repeated-sprints, in the distance jumped, in the running distance in a high-intensity simulated football match. Furthermore, Alford et al. (2001) investigated the effect of Red Bull in young adults by using psychomotor test batteries and cycling ergometer. The authors compared Red Bull with carbonated water, and they presented that both aerobic endurance (Red Bull 18.5 min, carbonated water 16.9 min) and anaerobic performance (1.4 sec more) increased. Forbes et al. (2007) found that Red Bull increased upper body muscle endurance (Red Bull group 34 ± 9 repetitions, Placebo group 32 ± 8 repetitions); however, it did not affect the anaerobic performance of the participant during Wingate cycling ergometer test. Lastly, Astorino et al. (2012) reported in their study with 15 college female footballers that Red Bull (1.3 mg/kg caffeine) consumed 60 minutes before exercise did not affect the repeated sprint performance.

Athletes who consume energy drinks should be informed about the caffeine restrictions in sports management authorities and as well as about the possible adverse effects of the components of these drinks. To reduce the withdrawal symptoms, it is advised that the athletes avoid consuming any food or beverages containing caffeine a week before competitions (Ballard et al., 2010). Consumption of Red Bull is a choice, so claims and scientific evidence about the drink and its components and side effects should be carefully taken into consideration when this decision is made (Laquale, 2007). Despite their current large and growing marketing, and also the claims of their ergogenic benefits, there are not many printed researches on this issue that energy drinks improve the human performance and on energy drinks themselves.

In conclusion, there observed no significant difference between the groups' results of Yo-Yo Intermittent Endurance Test (Level 1) and Wingate Anaerobic Power Test which were conducted with male footballers studying in School of Physical Education and Sports. This study which was conducted while considering the unconscious consumption of caffeine and its possible side effects was concluded that consuming sugar-free Red Bull 60 minutes before exercise had no affect on aerobic and anaerobic parameters of footballers. Nevertheless, this study is particular when the effect of Red Bull on aerobic and anaerobic performances of athletes is tried to be discovered. The results obtained from this study will contribute to further research as well.

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